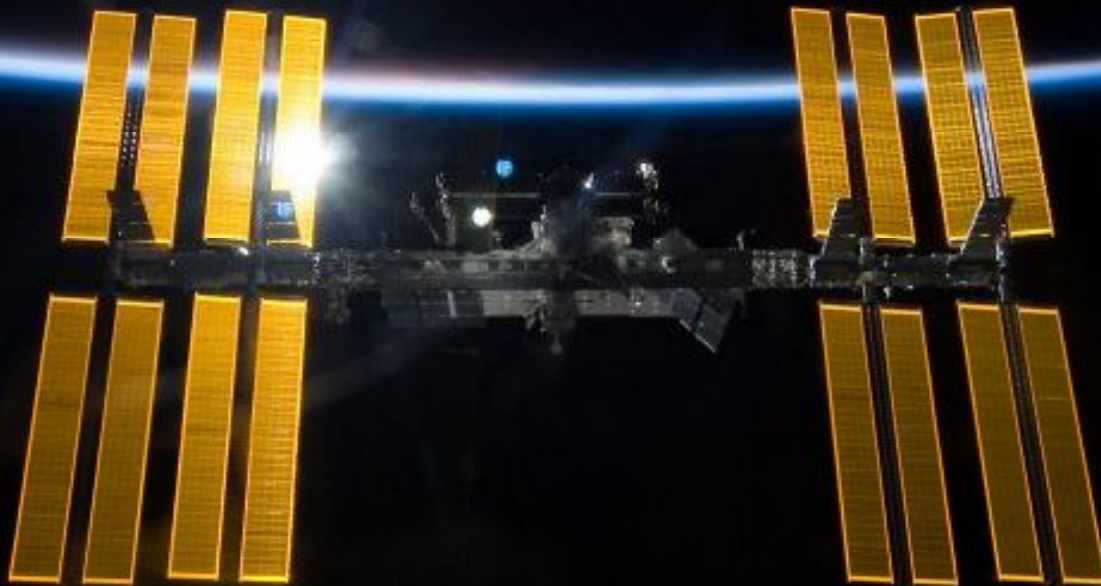


Space Paradigm Shift

Bruce Pittman
Space Portal Office



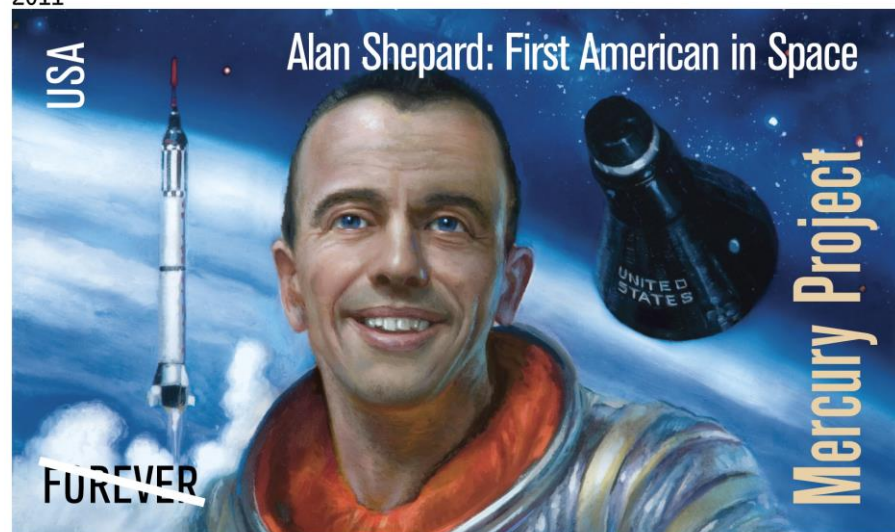
Space Paradigm Shift

- A paradigm is a set of rules or a model for how to solve problems and achieve success
- Described by Thomas Kuhn 1962 in his book “The Structure of Scientific Revolutions”
- The international space program is undergoing a major paradigm shift and this shift provides a window of opportunity for innovation and for new players to enter

Start of the Space Race



2011



May 25, 1961 - Apollo Is Born



USA Wins!



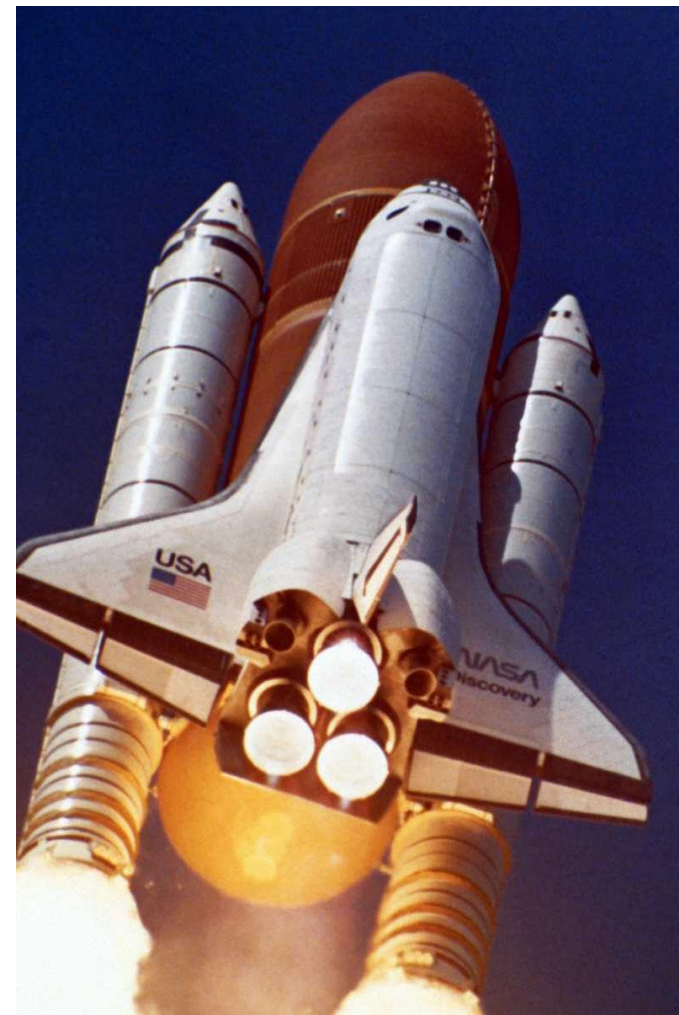
Space Paradigm Shift

	<i>Old Paradigm</i>	<i>New Paradigm</i>
Funding	• Government	• Govt & Private
Satellites	• Big/Expensive	• Small/Cheap
Schedules	• Long/Years	• Short/Months
Entry Barriers	• High	• Much Lower
Competition	• None	• Multiple
Hardware	• Expendable	• Reusable
Public Role	• Spectator	• Participant
Contract Type	• Cost Plus	• Fixed Price/SAA
Risk Tolerance	• Low	• High

Space Shuttle & ISS

1981-2012

1999-Present



Paradigm Pioneers

Starting in the 1990's a number of visionary new players entered into the commercial space arena and they brought their own money

Blue Origin - Jeff Bezos - Amazon.com

SpaceX - Elon Musk – PayPal

Bigelow Aerospace - Bob Bigelow - Budget Suites of America

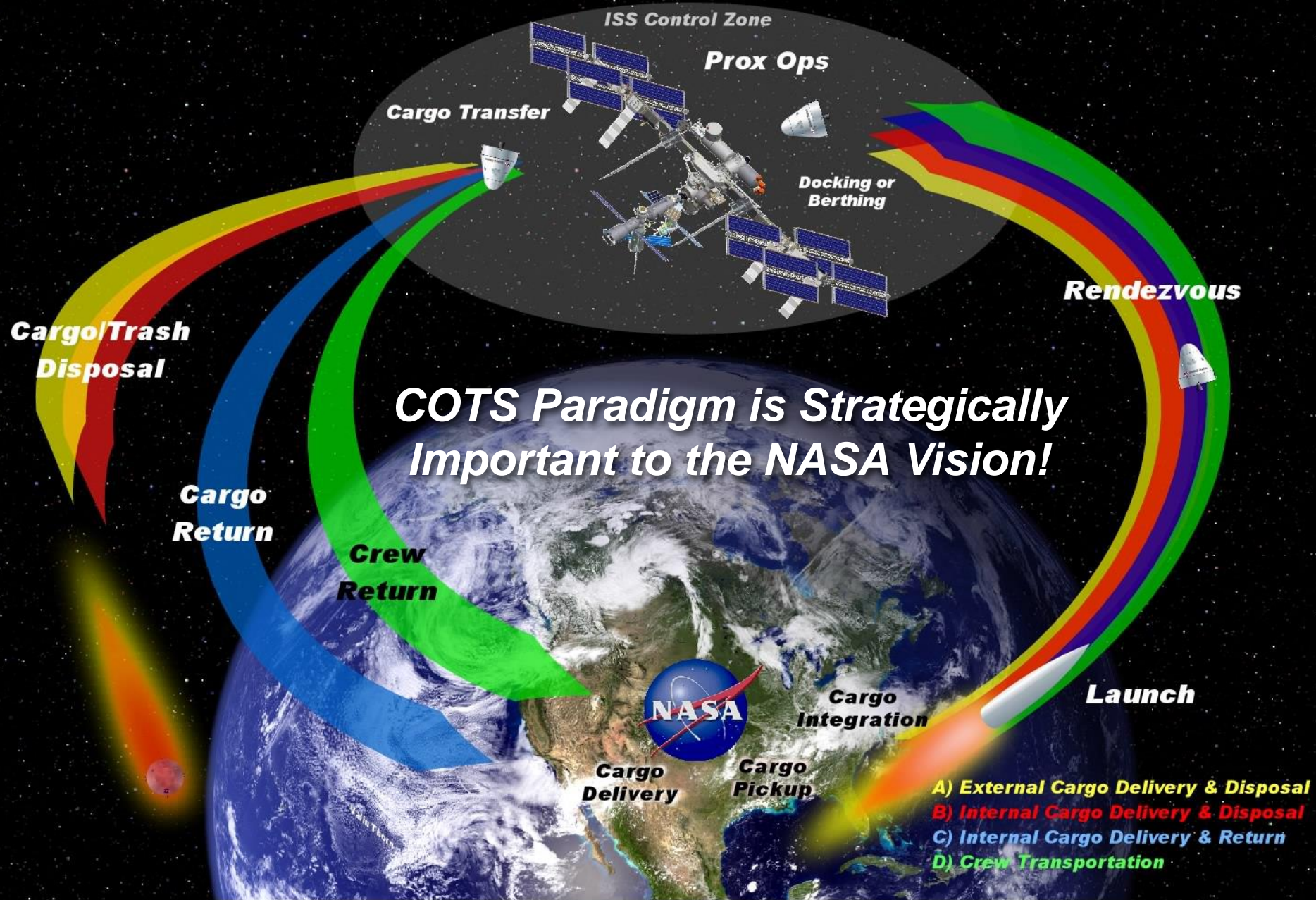
Planetary Resources – Peter Diamandis & Eric Anderson with Larry Page, Eric Schmidt – Google plus several others

Virgin Galactic - Richard Branson - Virgin Group

Stratolaunch – Paul Allen – Microsoft/Vulcan Ventures

NASA Commercial Crew/Cargo Project

Commercial Orbital Transportation Service



Elon & SpaceX Falcon



Bezos & Blue Origin



Canada



United Arab Emirates



Luxembourg

Asteroid Mining Will Create A Trillion-Dollar Industry

As our **population grows** we need to find a **sustainable supply of natural resources** to fuel exploration in space and prosperity on Earth.



MORE ASTEROIDS DISCOVERED NEAR EARTH EVERYDAY



WATER-RICH ASTEROID

One water-rich asteroid could produce **enough** fuel for every rocket launched in history.

USES OF WATER IN SPACE



ROCKET FUEL



BREATHABLE AIR

PLATINUM-RICH ASTEROID

Could contain more Platinum Group Metals than what's been mined on Earth in all of history

NEAR-INFINITE SUPPLY OF PRECIOUS RESOURCES

ONE SINGLE 500M water-rich asteroid

trillion

would produce over \$5 trillion

It currently costs \$20,000 to send a liter of water from Earth

USES OF PLATINUM GROUP METALS ON EARTH

REDUCE COST OF ELECTRONICS

ELECTRIFY TRANSPORTATION

DRIVE INNOVATION, AND CREATE A GREENER EARTH



ONE SINGLE 500M platinum-rich asteroid

Worth \$2.9 Trillion

At current market prices, one ounce of platinum is valued over \$1,500

174 times

more than the yearly world output of platinum

50%

More than the known world-reserves of PGMs

Asteroid mining will open a trillion-dollar industry and provide a **near-infinite supply** of Platinum Group Metals and water to **support our growth** both on this planet and off



Questions?